WHAT IS CLAIMED IS:

1. A polymer electrolyte fuel cell comprising a membrane-form polymer electrolyte, a cathode disposed on one side of the polymer electrolyte, and an anode disposed on the other side of the polymer electrolyte, wherein the cathode comprises a catalyst and an ion exchange resin, and the ion exchange resin is made of a polymer comprising the following segments A and segments B:

Segments A: segments made of a polymer having sulfonic acid groups; and

Segments B: segments made of a fluoropolymer having substantially no ion exchange groups.

2. The polymer electrolyte fuel cell according to Claim 1, wherein the ion exchange resin is made substantially of a perfluoropolymer.

3. The polymer electrolyte fuel cell according to Claim 2, wherein the ion exchange resin is obtained by hydrolyzing a polymer comprising segments made of an amorphous polymer having fluorosulfonyl groups and segments made of an amorphous polymer having substantially no ion exchange groups and converting it into an acid form.

4. The polymer electrolyte fuel cell according to Claim 1, wherein the segments B have alicyclic structures in their main chains.

5. The polymer electrolyte fuel cell according to Claim

4, wherein the ion exchange resin is made of a polymer wherein the segments A are the following segments C, and the segments B are the following segments D, and its molecular weight is from 5×10^3 to 5×10^6:

Segments C: segments made of a copolymer comprising repeating units based on a perfluorovinyl ether having a sulfonic acid group and repeating units based on tetrafluoroethylene, wherein the repeating units based on the perfluorovinyl ether are contained in an amount of at least 20 mol%; and

Segments D: segments made of a perfluoropolymer having no ion exchange groups and having alicyclic structures in its main chain.

6. The polymer electrolyte fuel cell according to Claim 1, wherein the ion exchange resin is made of a polymer wherein the segments A are the following segments C, and the segments B are the following segments E, and its molecular weight is from 5×10^3 to 5×10^6:

Segments C: segments made of a copolymer comprising repeating units based on a perfluorovinyl ether having a sulfonic acid group and repeating units based on tetrafluoroethylene, wherein the repeating units based on the perfluorovinyl ether are contained in an amount of at least 20 mol%; and

Segments E: segments made of a copolymer having no ion exchange groups and comprising repeating units based on a perfluorovinyl ether and repeating units based on

tetrafluoroethylene, wherein the repeating units based on the perfluorovinyl ether are contained in an amount of at least 20 mol%.

7. The polymer electrolyte fuel cell according to Claim 1, wherein the ion exchange resin contains the segments A and the segments B in a mass ratio of from 95/5 to 5/95.

8. The polymer electrolyte fuel cell according to Claim 1, wherein the ion exchange resin is a resin obtained by a process of carrying out the following polymerization 1 in the presence of an iodine-containing fluoro-compound, and then carrying out the following polymerization 2 in the presence of the obtained polymer, or a process of carrying out the following polymerization 2, and then carrying out the following polymerization 1 in the presence of the obtained polymer:

Polymerization 1: homopolymerization of a perfluoro(vinyl ether) monomer having a $-SO_2X$ group (wherein X is a chlorine atom, a fluorine atom or OM, wherein M is a hydrogen atom, an alkali metal atom or NH_4), or copolymerization thereof with other perfluoromonomer, by an iodine transfer polymerization method; and

Polymerization 2: homopolymerization of a perfluoromonomer having no ion exchange groups, or copolymerization of plural perfluoromonomers having no ion exchange groups, by an iodine transfer polymerization method.

9. The polymer electrolyte fuel cell according to Claim 8, wherein the iodine-containing fluoro-compound is a perfluoroalkyl monoiodide.

10. A block polymer comprising the following segments C' and the following segments D and having a molecular weight of from 5×10^3 to 5×10^6:

Segments C': segments made of a copolymer comprising repeating units based on a perfluorovinyl ether having a $-SO_2X$ group (wherein X is a fluorine atom, a chlorine atom or OM wherein M is a hydrogen atom, an alkali metal atom or $NR^1R^2R^3R^4$, wherein each of R^1, R^2, R^3 and R^4 which are independent of one another, is a hydrogen atom or a monovalent organic group) and repeating units based on tetrafluoroethylene, wherein the repeating units based on the perfluorovinyl ether are contained in an amount of at least 20 mol%; and

Segments D: segments made of an amorphous perfluoropolymer having no ion exchange groups and having alicyclic structures in its main chain.

11. The block polymer according to Claim 10, wherein the segments D are made of poly(perfluoro(3-butenyl vinyl ether)), poly(perfluoro(allyl vinyl ether)), poly(perfluoro(3,5-dioxa-1,6-heptadiene)), poly(perfluoro(2,2-dimethyl-1,3-dioxole)), poly(perfluoro(1,3-dioxole)), poly(perfluoro(4-methoxy-1,3-dioxole)), a tetrafluoroethylene/perfluoro(2,2-dimethyl-1,3-dioxole) copolymer or poly(perfluoro(2-

methylene-4-methyl-1,3-dioxolane)).

12. The block polymer according to Claim 10, wherein the mass ratio of the segments C' to the segments D is from 95/5 to 5/95.

13. A block polymer comprising the following segments C' and the following segments E and having a molecular weight of from 5×10^3 to 5×10^6:

Segments C': segments made of a copolymer comprising repeating units based on a perfluorovinyl ether having a $-SO_2X$ group (wherein X is a fluorine atom, a chlorine atom or OM wherein M is a hydrogen atom, an alkali metal atom or $NR^1R^2R^3R^4$, wherein each of R^1, R^2, R^3 and R^4 which are independent of one another, is a hydrogen atom or a monovalent organic group) and repeating units based on tetrafluoroethylene, wherein the repeating units based on the perfluorovinyl ether are contained in an amount of at least 20 mol%; and

Segments E: segments made of an amorphous copolymer having no ion exchange groups and comprising repeating units based on a perfluoro(alkyl vinyl ether) and repeating units based on tetrafluoroethylene, wherein the repeating units based on the perfluoro(alkyl vinyl ether) are contained in an amount of at least 20 mol%.

14. The block polymer according to Claim 13, wherein the perfluoro(alkyl vinyl ether) is a compound represented by the formula $CF_2=CF-(OCF_2CFZ)_t-O-R^f$ (wherein Z is a fluorine atom or a trifluoromethyl group, R^f is a linear

or branched C_{1-12} perfluoroalkyl group, and t is an integer of from 0 to 3).

15. The block polymer according to Claim 13, wherein the mass ratio of the segments C' to the segments E is from 95/5 to 5/95.

16. The block polymer according to Claim 10, which is a perfluoropolymer having no glass transition temperature higher than 270°C and wherein no segments having a crystalline melting point are present, or when segments having a crystalline melting point are present, such a crystalline melting point is not higher than 270°C, and X is a fluorine atom or a chlorine atom.

17. The block polymer according to Claim 13, which is a perfluoropolymer having no glass transition temperature higher than 270°C and wherein no segments having a crystalline melting point are present, or when segments having a crystalline melting point are present, such a crystalline melting point is not higher than 270°C, and X is a fluorine atom or a chlorine atom.

18. A process for producing a polymer, which comprises polymerizing a first monomer group comprising one or more fluoromonomers in the presence of a first radical initiator and an iodine-containing fluoro-compound in a non-aqueous medium or in the absence of any solvent, to prepare a substantially amorphous polymer, and then, polymerizing a second monomer group comprising one or more monomers different from the first monomer group in

the presence of the polymer and a second radical initiator in a non-aqueous medium or in the absence of any solvent.

19. The process for producing a polymer according to Claim 18, wherein the second monomer group comprises fluoromonomers, and the polymer obtainable after the polymerization of the second monomer group is substantially amorphous.

20. The process for producing a polymer according to Claim 18, wherein one of the first monomer group and the second monomer group is the following monomer group c and the other is the following monomer group d:

Monomer group c: a perfluorovinyl ether having a $-SO_2X'$ group (wherein X' is a fluorine atom or a chlorine atom) and tetrafluoroethylene; and

Monomer group d: a perfluoromonomer having no ion exchange groups and having an alicyclic structure, or a perfluoromonomer having no ion exchange groups and having an alicyclic structure and at least one other perfluoromonomer having no ion exchange groups.

21. The process for producing a polymer according to Claim 18, wherein one of the first monomer group and the second monomer group is the following monomer group c and the other is the following monomer group d':

Monomer group c: a perfluorovinyl ether having a $-SO_2X'$ group (wherein X' is a fluorine atom or a chlorine atom) and tetrafluoroethylene; and

Monomer group d': a perfluoromonomer having no ion exchange groups and having two double bonds and being capable of cyclopolymerization, or a perfluoromonomer having no ion exchange groups and having two double bonds and being capable of cyclopolymerization and at least one other perfluoromonomer having no ion exchange groups.

22. The process for producing a polymer according to Claim 18, wherein one of the first monomer group and the second monomer group is the following monomer group c and the other is the following monomer group e:

Monomer group c: a perfluorovinyl ether having a $-SO_2X'$ group (wherein X' is a fluorine atom or a chlorine atom) and tetrafluoroethylene; and

Monomer group e: a perfluoro(alkyl vinyl ether) having no ion exchange groups and tetrafluoroethylene.

23. The process for producing a polymer according to Claim 19, wherein one of the first monomer group and the second monomer group is the following monomer group c and the other is the following monomer group d:

Monomer group c: a perfluorovinyl ether having a $-SO_2X'$ group (wherein X' is a fluorine atom or a chlorine atom) and tetrafluoroethylene; and

Monomer group d: a perfluoromonomer having no ion exchange groups and having an alicyclic structure, or a perfluoromonomer having no ion exchange groups and having an alicyclic structure and at least one other perfluoromonomer having no ion exchange groups.

24. The process for producing a polymer according to Claim 19, wherein one of the first monomer group and the second monomer group is the following monomer group c and the other is the following monomer group d':

Monomer group c: a perfluorovinyl ether having a $-SO_2X'$ group (wherein X' is a fluorine atom or a chlorine atom) and tetrafluoroethylene; and

Monomer group d': a perfluoromonomer having no ion exchange groups and having two double bonds and being capable of cyclopolymerization, or a perfluoromonomer having no ion exchange groups and having two double bonds and being capable of cyclopolymerization and at least one other perfluoromonomer having no ion exchange groups.

25. The process for producing a polymer according to Claim 19, wherein one of the first monomer group and the second monomer group is the following monomer group c and the other is the following monomer group e:

Monomer group c: a perfluorovinyl ether having a $-SO_2X'$ group (wherein X' is a fluorine atom or a chlorine atom) and tetrafluoroethylene; and

Monomer group e: a perfluoro(alkyl vinyl ether) having no ion exchange groups and tetrafluoroethylene.

26. The process for producing a polymer according to Claim 18, wherein the iodine-containing fluoro-compound is a perfluoroalkyl monoiodide.

27. A liquid composition which comprises an organic solvent having an alcoholic hydroxyl group and a block

polymer comprising the following segments C" and the following segments D and having a molecular weight of from 5×10^3 to 5×10^6, dissolved or dispersed in the organic solvent:

Segments C": segments made of a copolymer comprising repeating units based on a perfluorovinyl ether having a $-SO_3M$ group (wherein M is a hydrogen atom, an alkali metal atom or $NR^1R^2R^3R^4$, wherein each of R^1, R^2, R^3 and R^4 which are independent of one another, is a hydrogen atom or a monovalent organic group) and repeating units based on tetrafluoroethylene, wherein the repeating units based on the perfluorovinyl ether are contained in an amount of at least 20 mol%; and

Segments D: segments made of an amorphous perfluoropolymer having no ion exchange groups and having alicyclic structures in its main chain.

28. The liquid composition according to Claim 27, wherein the segments D are made of poly(perfluoro(3-butenyl vinyl ether)), poly(perfluoro(allyl vinyl ether)), poly(perfluoro(3,5-dioxa-1,6-heptadiene)), poly(perfluoro(2,2-dimethyl-1,3-dioxole)), poly(perfluoro(1,3-dioxole)), poly(perfluoro(4-methoxy-1,3-dioxole)), a tetrafluoroethylene/perfluoro(2,2-dimethyl-1,3-dioxole) copolymer or poly(perfluoro(2-methylene-4-methyl-1,3-dioxolane)).

29. A liquid composition which comprises an organic solvent having an alcoholic hydroxyl group and a block

polymer comprising the following segments C" and the following segments E and having a molecular weight of from 5×10^3 to 5×10^6, dissolved or dispersed in the organic solvent:

Segments C": segments made of a copolymer comprising repeating units based on a perfluorovinyl ether having a $-SO_3M$ group (wherein M is a hydrogen atom, an alkali metal atom or $NR^1R^2R^3R^4$, wherein each of R^1, R^2, R^3 and R^4 which are independent of one another, is a hydrogen atom or a monovalent organic group) and repeating units based on tetrafluoroethylene, wherein the repeating units based on the perfluorovinyl ether are contained in an amount of at least 20 mol%; and

Segments E: segments made of an amorphous copolymer having no ion exchange groups and comprising repeating units based on a perfluoro(alkyl vinyl ether) and repeating units based on tetrafluoroethylene, wherein the repeating units based on the perfluoro(alkyl vinyl ether) are contained in an amount of at least 20 mol%.

ABSTRACT OF THE DISCLOSURE

A polymer electrolyte fuel cell comprising a membrane-form polymer electrolyte, a cathode disposed on one side of the polymer electrolyte, and an anode disposed on the other side of the polymer electrolyte, wherein the cathode comprises a catalyst and an ion exchange resin, and the ion exchange resin is made of a polymer comprising the following segments A and segments B:

Segments A: segments made of a polymer having sulfonic acid groups; and

Segments B: segments made of a fluoropolymer having substantially no ion exchange groups.